## REMARKS

Claims 1 to 10 are pending. Claim 1 is amended.

Claims 6 to 10 are withdrawn from consideration pursuant to a Restriction Requirement.

Claim Rejections - 35 U.S.C. § 112:

Claim 1 is rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

Claim 1 is amended to remove the recitation "and less than 100% of said reinforcing particles being less than 10 layers thick". Moreover, amended claim 1 now includes the limitation "and wherein at least some of the reinforcing particles are not completely exfoliated". This limitation is supported by the specification as originally filed on page 11, lines 15-21 where it is disclosed that the exfoliation (delamination and dispersion) of layered mineral particles into constituent layers need not be complete in order to achieve the objects of the present invention. No new subject matter is added by way of this limitation. Applicant submits that amended claim 1 is fully supported by the specification as originally filed and in compliance with the written description requirement. Withdrawal of the rejection is respectfully requested.

Claim Rejections - 35 U.S.C. § 103:

Claims 1 to 3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Okada et al. (U.S. Patent No. 4,739,007) in view of Christiani et al. (U.S. Patent No. 5,747,560).

Applicant respectfully traverses the rejection of claims 1 to 3 as being unpatentable over Okada et al. in view of Christiani et al.

Claim 1 is amended as discussed heretofore. The limitation "and wherein at least some of the reinforcing particles are not completely exfoliated" is added to more clearly distinguish the present invention as defined in claim 1 from the prior art of record.

The Office Action states that a teaching to about less than 10 layers would encompass values less than 10 layers and values greater than 10 layers, and hence it was concluded that the combination of Okada et al. in view of Christiani et al. teaches all of the limitations of claim 1.

Applicant respectfully disagrees with this conclusion. Christiani et al. teach that where intercalation is incomplete between some layers, those layers will not delaminate in the polymer melt, and will form platelet particles comprising those layers in coplanar aggregates. Christiani et al. go on further that these coplanar aggregates will only provide enhanced properties over and above those provided by conventional micro-scale fillers, as long as they are less than about 10 layers thick and preferably less than 5 layers thick. The term "about" is defined in "The Concise Oxford Dictionary of Current English", Eighth Edition, 1990, as "approximately" or "fairly correct or accurate; near to the actual; bring or come near (esp. in quality, number, etc.), but not exactly". The term "less" is defined as "smaller in extent, degree, duration, numbers, etc.; smaller amount or quantity or number". Thus, it is submitted that the teaching of Christiani et al. to particles of "less than about 10 layers and preferably less than 5 layers" includes only minor variations from 10 layers, i.e. near 10 layers but not exactly 10 layers with a tendency towards a smaller particle size. Applicant's invention as defined in claim 1 recites that at least 50% of the reinforcing particles are less than about 20 layers thick, and at least 99% of the reinforcing particles are less than about 30 layers thick. A thickness of "less than about 20 layers" and a thickness of "less than about 30 layers" corresponds to twice and thrice, respectively, the thickness disclosed by Christiani et al., viz. less than about 10 layers. A thickness of "less than about 20 layers" and "less than about 30 layers" deviates substantially from approximately 10 layers. Thus, Applicant respectfully submits that twice or three times the size of the reinforcing particles is not encompassed by the disclosure of Christiani et al. to a thickness of less than about 10 layers.

The naturally occurring geometry of layered silicates or clay particles is a stacked geometry of individual platelets. In clay soils, clay particles are typically arranged along a horizontal plane in a plate-like structure. When these horizontal aggregations are stacked high and consolidated over time, they can be quite tight and

sticky. It is generally accepted in the prior art that the preparation of nanocomposites requires extensive delamination of the layered clay structure and complete dispersion of the resulting platelets throughout the polymer matrix. Thus, it is believed that consistent improvements in the properties of clay loaded polymeric systems can be achieved by minimizing clay aggregation as much as possible, promoting the formation of chemical bonds between polymer and clay and achieving an exfoliation of the layered silicate or clay mineral. In accordance with the prior art, an exfoliated nanocomposite is the most desirable structure. As stated heretofore, nanocomposites are obtained by dispersing clay particles in a polymer matrix. The prior art provides evidence that exfoliation and dispersion of clay platelets during nanocomposite preparation and clay matrix adhesion are major technical issues that need to be addressed in order to achieve the desired property enhancements in polymer-clay nanocomposites [P.B. Messersmith, E.P. Giannelis, Chem. Mater. 5, 1064 (1993); H. Shi, T. Lan, and T. Pinnavaia, Chem. Mater. 8, 2216 (1996); I.J. Chin, T. Thurn-Albrecht, H.C. Kim, T.P. Russell, Polymer, 42, 5947 (2001); J.M. Brown, D. Curliss, and R.A. Vaia, Chem. Mater. 12 (11), 3376 (2000); C. Zilg, R. Thomann, J. Finter, and R. Mulhaupt, Macromol. Mater. Eng. 280, 41 (2000); and X. Fu and S. Qutubuddin, Polymer, 42 (4), 807 (2001)]. Therefore, the prior art discloses methods to improve exfoliation to achieve complete or almost complete exfoliation. In an exfoliated structure, the layers of the silicate or clay mineral are completely separated and the individual layers are distributed throughout the polymeric matrix. In such nanocomposites, the interfacial effect between the silicate layers and matrix polymers is a key factor leading to high stiffness, high modulus and heat resistant composites [P.B. Messersmith, E.P. Giannelis, Chem. Mater. 6, 1719 (1994)] which can be by far superior to conventional glass fiber reinforced plastics, provided that the silicate layers are completely exfoliated and thoroughly homogenized into the polymer matrix [M. Okamoto et al., Polymer 41 (2000) 3887-3890]. However, usually very strong electrostatic interactions between silicate layers through intergallery cations make it extremely difficult to achieve complete exfoliation of the layers. Therefore, the prior art discloses efforts to avoid this difficulty and to achieve complete exfoliation of the particles through the development of a compatibilizer chemistry as a key factor in the expansion of this nanotechnology, for example, by replacing such cations by some quarternized ammonium salts.

Accordingly, Christiani et al. also disclose that almost complete exfoliation is necessary to provide nanocomposites exhibiting enhanced properties over and above those provided by conventional micro-scale fillers. Thus, the effective swelling/compatibilizing agents may be introduced into the spaces between every layer, nearly every layer, or a large fraction of the layers of the layered material such that the resulting platelet particles comprise less than about 10 layers in thickness (Christiani et al., column 6, lines 56-61).

However, the present invention, as originally filed, teaches that the dispersion of the layers is achieved by mixing with high shear (p. 9, line 24 – p. 10, line 4) and that the exfoliation (delamination and dispersion) of layered mineral particles into constituent layers does not need to be complete to achieve the objects of the present invention (p. 11, lines 15-21). Thus, claim 1 as originally filed defines that at least 50% of said reinforcing particles being less than about 20 layers thick, at least 99% of said reinforcing particles being less than about 30 layers thick, and said layers having a thickness of between about 0.7 nm and 1.2 nm. Amended claim 1 further defines that "at least some of the reinforcing particles are not completely exfoliated" to more clearly distinguish the present invention from the prior art.

The teaching of the instant invention as defined in amended claim 1 is in contrast to the teachings of the prior art where it is stated that complete or nearly complete exfoliation is a key factor in achieving nanocomposites with enhanced properties. Furthermore, the present invention provides advantages over the prior art since it reduces the efforts in achieving an exfoliation of the layered mineral particles and hence it reduces the time and cost of providing reinforcing particles in accordance with the present invention. For example, the instant invention obviates the use of a compatibilizer chemistry by mixing with high shear to disperse the layers and further teaches that the exfoliation of layered mineral particles does not need to be complete.

The particles disclosed by Christiani et al. are a finer fraction of layered mineral particles, i.e. the platelet particles disclosed by Christiani et al. are less than about 10 layers thick and preferably less than about 5 layers thick.. In accordance with the present invention as defined in claim 1, the reinforcing particles can be more coarse in comparison to Christiani et al., viz. at least 50 percent are less than about 20 layers thick and at least 99% of said reinforcing particles are less than about 30 layers thick.

Thus, Applicant submits, that Christiani et al. may actually be viewed as teaching away from the instant invention as claimed, in which it was found that exfoliation of the layered mineral particles into constituent layers does not need to be complete, as reflected by the claim-specified values. Furthermore, as discussed in the previous response, Okada et al. disclose a process that yields finely dispersed silicate (clay) layers in the order of magnitude of molecular dimensions (in a thickness of about 10 Å) that are firmly combined with the chains of the intercalated polymer. Okada et al. teach that a fine dispersion of the silicate layers brings about the particular advantages of their invention, see column 8, lines 1-17, and column 8, lines 27-37. Therefore, the prior art does not provide any motivation to provide reinforcing particles in which the exfoliation of the layered mineral particles is not complete. Applicant submits, therefore, that the present invention as defined in amended claim 1 would not have been obvious in view of the teachings of the prior art and that the present invention is not obvious when combining the teaching of Okada et al. in view of Christiani et al.

Further with regard to the protrusion limitations of claim 1, Applicant respectfully submits that the protrusions in accordance with the present invention are different from an embossed surface of a sheet or panel as disclosed by Christiani et al. Christiani et al. teaches (col. 24, lines 33-49) that their molding compositions are suitable for the production of sheets and panels. The sheets and panels can then be further shaped by various processes, such as embossing. Plastic sheets are frequently embossed to provide specific patterns or texture. Sheet-type products are run under embossing rolls that are textured with a pattern. In plastic sheet processing this is commonly done under heat and/or pressure. Embossing creates only slight variations in surface height that are generally less than 10% of the wall thickness. The present invention teaches structural elements that enhance the functional mechanical performance of the molded articles. The protrusions in accordance with the present invention as defined in amended claim 1 are integrally molded with the main portion and protruding from one of said surfaces. For example, thin, reinforced molded-in inserts for screws, bearings, or other attachments in automotive trim may be produced by compression molding in accordance with the instant invention. Reinforced bosses or other hollow circular standoffs into which a screw can be thread can also be made as well as reinforced bosses having small ribs for even greater reinforcement. Stiffening ribs can be integrally molded into the mobile interior trim. Rib forming

hooks may also be reinforced according to the invention. All such integrally molded, reinforced protruding elements have a thickness of less than 1/10 inch and extend from a primary trim portion or body (p. 10, line 20 – p. 11, line 3).

The protrusions in accordance with the invention are integrally molded to the main portion of the molded article. Furthermore, the protrusions in accordance with the instant invention have a height of at least twice the thickness of said protrusion. The embossed structure disclosed by Christiani et al. is not integrally molded with the article. Further, Christiani et al. does not provide a structurally reinforcing member as in the instant invention. It would not have been obvious to a person of ordinary skill in the art to provide a protrusion integrally molded with the main portion and protruding from one of the surfaces in view of the disclosure by Christiani et al. disclosing the further processing of a molded sheet and panel by embossing to provide a textured surface.

In view of the amendment of claim 1 and the foregoing discussion, Applicant submits that claim 1 is allowable, and withdrawal of the rejection is respectfully requested. Claims 2-5 ultimately depend from claim 1 and are likewise submitted to be allowable for at least the reason above. Withdrawal of the rejection is respectfully requested.

Applicant kindly requests reconsideration of this Application.

Instructions to charge a one (1) month extension fee against our deposit account are attached herewith.

It is felt that an interview would expedite prosecution of this Application, please do not hesitate to contact applicant's representative at the number below.

Respectfully submitted,

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